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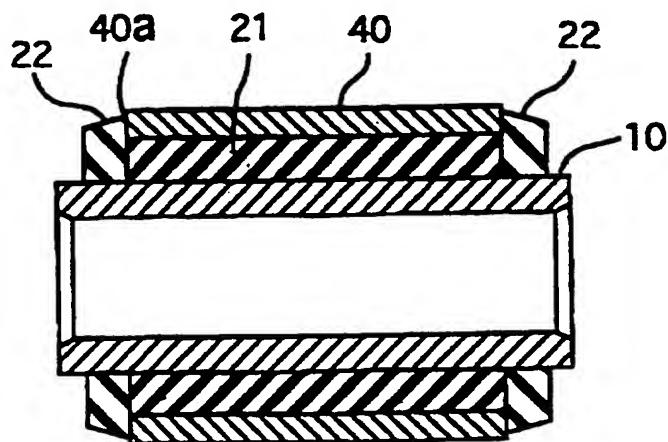
GB 0780233 A GB 0527780 A US 5439203 A

(58) Field of Search
UK CL (Edition O) F2S SCF
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(54) Antivibration bush

(57) An antivibration bush comprises an inner metal tube 10, a tubular rubber main body 21, and spaced annular rubber flange portions 22 at one or both ends of the tube 10. The elastic flange portions are of self-lubricating rubber having a lower friction coefficient than body 21. The bush is completed by a press-fit outer metal tube 40. The low-friction flanges reduce stick-slip noise.

FIG. 2



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FIG. 1

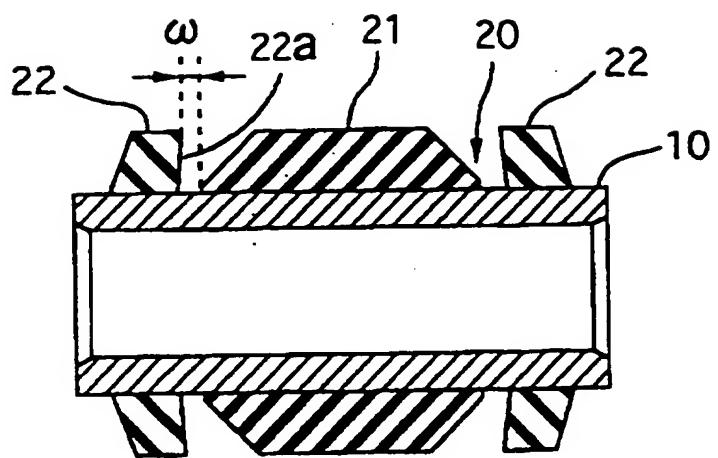


FIG. 2

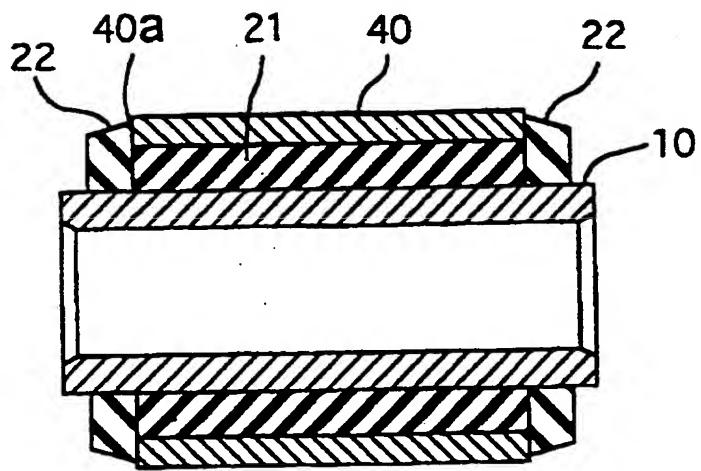


FIG. 3

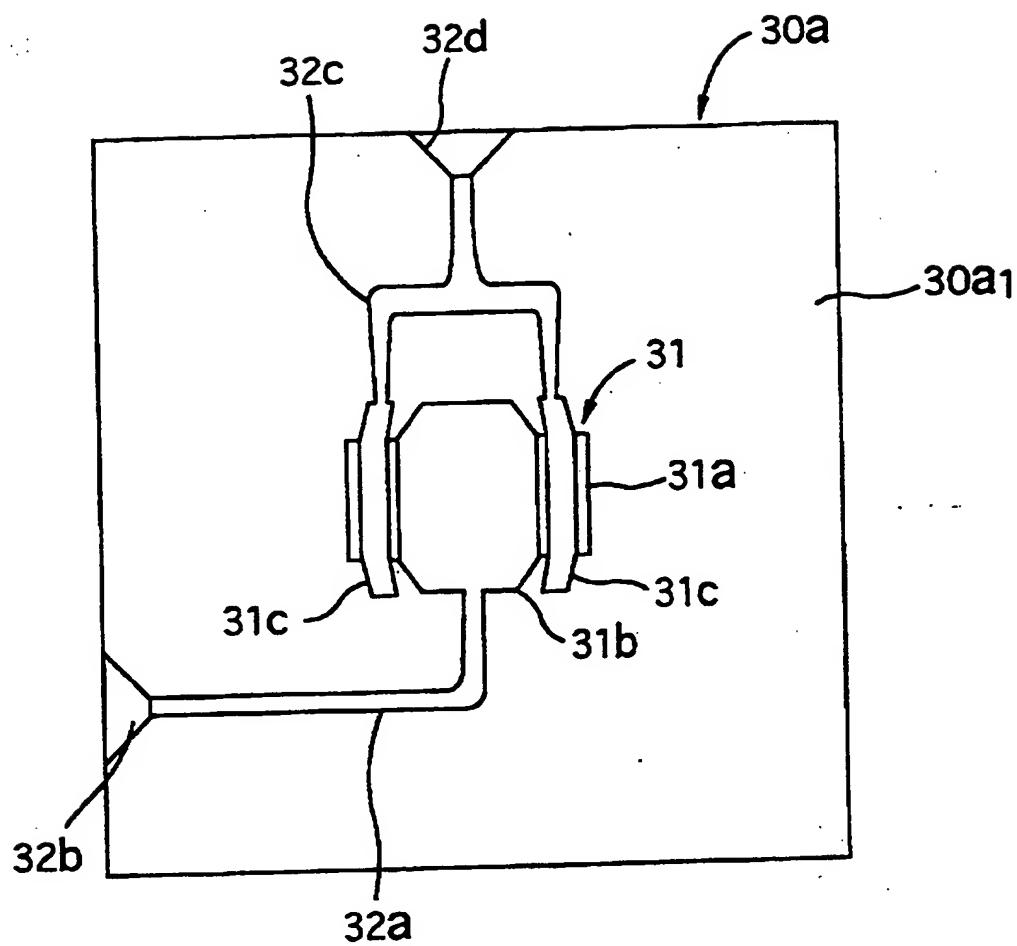


FIG. 4

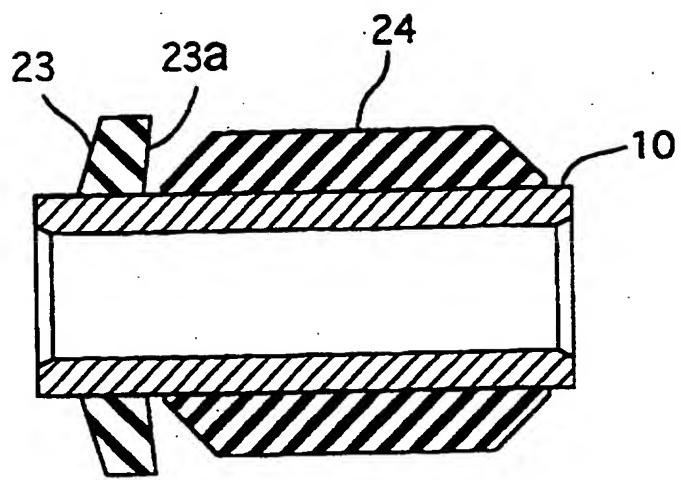


FIG. 5

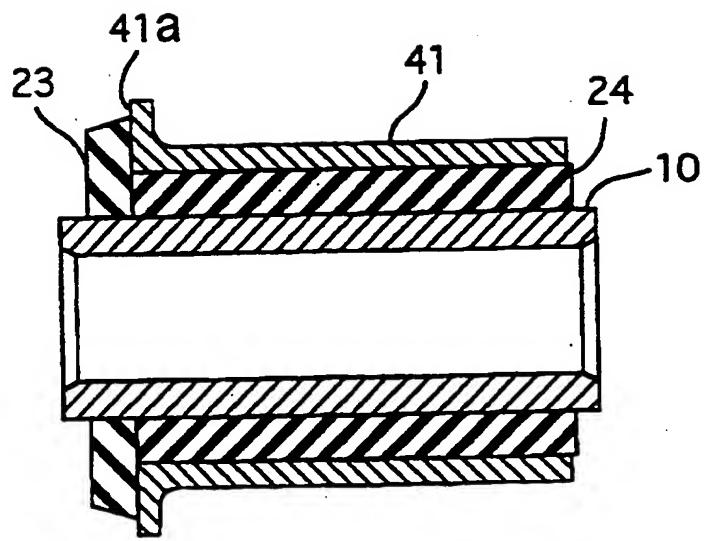


FIG. 6

(PR10R ART)

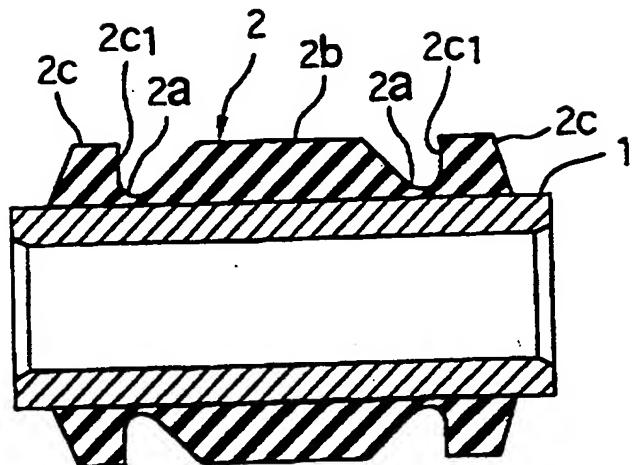


FIG. 7

(PR10R ART)

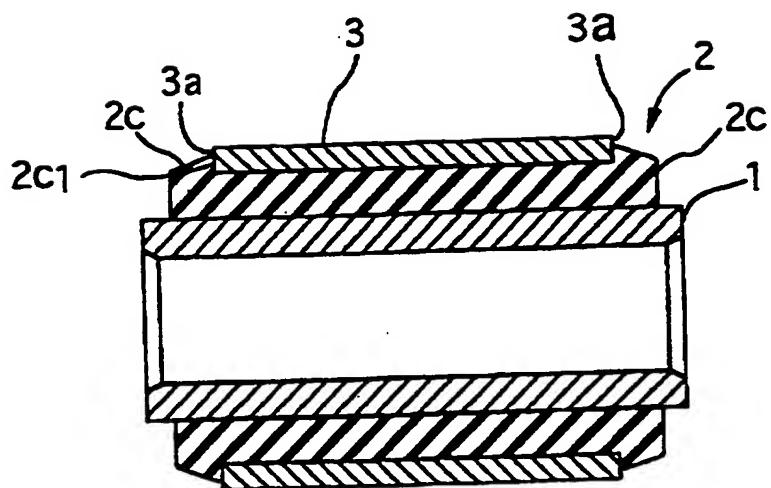
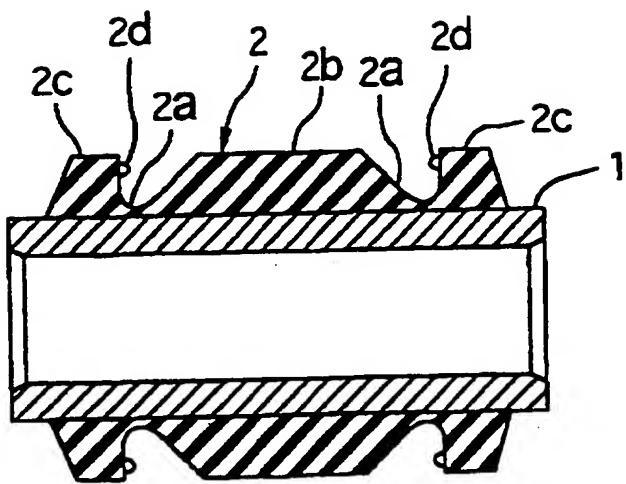


FIG. 8

(PR10R ART)



The entire disclosure of Japanese Patent Application No. 8-249406 filed on September 20, 1996 including the specification, drawings and abstract is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the invention

The present invention relates to a vehicular antivibration bush and, more particularly, to an antivibration bush that suppresses so-called stick-slip noise caused by friction between an outer tubular metal member and an elastic flange portion contacting the outer tubular metal member.

2. Description of the Related Art

A conventional vehicular antivibration bush, as shown in Fig. 6, has a tubular rubber elastic layer 2 that is adhered by vulcanization to an outer peripheral surface of an inner tubular metal member 1. The rubber elastic layer 2 has annular cutouts 2a near opposite ends of the inner tubular metal member 1, whereby the rubber elastic layer 2 is divided into a central elastic main body 2b and two end elastic flange portions 2c. The inner tubular metal member 1 carrying the rubber elastic layer 2 is fitted into an outer tubular metal member 3 so that the elastic main body 2b presses an inner peripheral surface of the outer tubular metal member 3 as shown in Fig. 7, thereby producing an antivibration bush.

The outer tubular metal member 3 has an inside diameter that is smaller than the outside diameter of the elastic flange portions 2c so

that opposite end surfaces 3a of the outer tubular metal member 3 contact inner side surfaces 2c1 of the elastic flange portions 2c. Therefore, the elastic flange portions 2c facilitate the positioning of the outer tubular metal member 3 in directions of the axis thereof, and prevent the outer tubular metal member 3 from falling apart from the rubber elastic layer 2. However, when the antivibration bush receives a force so that the inner tubular metal member 1 and the outer tubular metal member 3 displace relative to each other, the end surfaces 3a of the outer tubular metal member 3 and the inner side surfaces 2c1 of the elastic flange portions 2c slide on each other. Due to friction therebetween, the inner side surfaces 2c1 of the elastic flange portions 2c will likely undergo stick-slip movements and produce so-called stick-slip noise that annoys occupants in the vehicle.

To suppress the aforementioned stick-slip noise, a conventional antivibration bush has been proposed in, for example, Japanese Patent Publication No. Hei 7-74658, wherein silicon resin is applied mainly to contact portions 2c1 between the elastic flange portions 2c and the outer tubular metal member 3. In this antivibration bush, however, the applied silicon resin layer diminishes due to friction, thereby giving rise to a problem of incapability of continuing to stably suppress stick-slip noise over a long time.

Another antivibration bush has been proposed as in Japanese Utility Model Laid-Open No. Hei 7-34222 (see Fig. 8), many small protuberances 2d are formed serially circumferentially on inner side surfaces 2c1 of the elastic flange portions 2c that contact the opposite end surfaces 3a of the outer tubular metal members 3.

However, the stick-slip noise suppression achieved by this antivibration bush is not very effective. Furthermore, since the small protuberances 2d abrade due to contact with the outer tubular metal member 3, the antivibration bush is also incapable of suppressing stick-slip noise continuously over a long time.

Stick-slip noise can also be suppressed by an outer tube-adhered bush wherein an outer tubular metal member is adhered to an elastic main body using an adhesive instead of pressingly fitting it onto the elastic main body. However, the outer tube-adhered bush has a problem of high production costs, compared with the above-described pressed-on type of antivibration bush.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a pressed-on type antivibration bush that suppresses stick-slip noise at low costs, and a method for producing the pressed-on type antivibration bush.

To achieve the aforementioned object, the present inventors had an idea that it was necessary to form elastic flange portions from a self-lubricating rubber with a low friction coefficient, and to form an elastic main body from an ordinary rubber having a high friction coefficient. To form the elastic flange portions and the elastic main body from two different kinds of rubbers, the present inventors reached an idea of separating the elastic flange portions and the elastic main body, thereby accomplishing the present invention.

According to an aspect of the present invention, there is provided an antivibration bush having a cylindrical inner tubular metal member. An elastic flange portion is formed in an annular shape

from a second rubber with a low friction coefficient on an outer peripheral surface of the inner tubular metal member at least on an end side thereof. An elastic main body is formed in a tubular shape from a first rubber whose friction coefficient is greater than that of the second rubber, on an outer peripheral surface of the inner tubular metal member with a gap formed between the elastic main body and the elastic flange portion. An outer tubular metal member is pressingly fitted over an outer peripheral surface of the elastic main body. The outer tubular metal member has an end portion that contacts an end surface of the elastic flange portion, the end surface being relatively near to the elastic main body.

According to another aspect of the present invention, there is provided a method for producing an antivibration bush. In the method, a cylindrical inner tubular metal member is disposed in an inner tubular metal member placement cavity portion formed in a mold separable into two mold parts. The mold used in the method has, in addition to the inner tubular metal member placement cavity portion, at least one end cavity portion expanding in radial directions into a generally annular shape from an end portion of the inner tubular metal member placement cavity portion in the direction of an axis thereof, a second injection hole extending from an end surface of the mold to the end cavity portion, an intermediate cavity portion expanding in radial directions into a generally tubular shape from the inner tubular metal member placement cavity portion, the intermediate cavity portion being apart from the end cavity portion by an interval, and a first injection hole extending from an end surface of the mold to the intermediate cavity portion. The aforementioned cavities are distributed to the two mold parts substantially symmetrically about

parting surfaces of the mold parts. The mold is closed. A second rubber having a low friction coefficient is injected through the second injection hole into the second cavity portion. A first rubber having a friction coefficient that is greater than the friction coefficient of the second rubber is injected through the first injection hole into the intermediate cavity portion.

In the antivibration bush of the present invention, the elastic flange portion and the elastic main body are spaced apart from each other by a gap, so that they can be formed from different kinds of rubbers. As described above, the elastic flange portion is formed from the second rubber having a low friction coefficient, and the elastic main body is formed from the first rubber having a high friction coefficient. When vibration occurs in the bush so that the inner tubular metal member and outer tubular metal member displace relative to each other, friction occurs between an end of the outer tubular metal member and the elastic flange portion. However, since the elastic flange portion is formed from the low-friction coefficient second rubber, the friction therebetween is small so that stick-slip is unlikely to occur between the end of the outer tubular metal member and the elastic flange portion. Thereby, stick-slip noise by friction can be effectively suppressed. Furthermore, since the elastic main body is formed from the first rubber with a high friction coefficient, the outer tubular metal member can be securely fixed to the elastic main body without allowing slip therebetween.

The friction coefficient of the second rubber may be within a range of 0.1-0.5.

Further, the second rubber may contain fatty amide. The amount of fatty amide compounded may be 2-10 phr, wherein phr

indicates the proportion by weight of the fatty amide content to the rubber content that is determined as 100 parts.

The fatty amide-compounded rubber is good in adhesion to metal members, compared with, for example, a self-lubricating rubber that contains silicon. Use of the fatty amide-compounded rubber also achieves an advantage that it becomes unlikely that a lubricating component will deposit on a metal surface that contacts the rubber of the elastic main body.

The method for producing an antivibration bush of the present invention uses a mold separable into two mold parts. The mold has an inner tubular metal member placement cavity portion, at least one end cavity portion expanding in radial directions into a generally annular shape from an axial end portion of the inner tubular metal member placement cavity portion, a second injection hole extending from an end surface of the mold to the end cavity portion, an intermediate cavity portion expanding in radial directions into a generally tubular shape from the inner tubular metal member placement cavity portion, the intermediate cavity portion being apart from the end cavity portion by an interval, and a first injection hole extending from an end surface of the mold to the intermediate cavity portion. The aforementioned cavities are distributed to the two mold parts substantially symmetrically about parting surfaces of the mold parts. A second rubber is injected through the second injection hole into the end cavity portion, and a first rubber is injected through the first injection hole into the intermediate cavity portion.

The method is thus able to simultaneously mold two different kinds of rubbers using a single mold. The interval between the end cavity portion and the intermediate cavity portion of the mold merely

needs to be an interval such that the second rubber injected into the end cavity portion and the first rubber injected into the intermediate cavity portion are substantially prevented from mixing with each other.

Since two different kinds of materials can be molded by performing the mold closing operation once, the molding process for an antivibration bush according to the present invention can be simplified to a level substantially the same as in the conventional art. Therefore, the present invention makes it possible to produce an antivibration bush capable of effectively suppressing stick-slip noise at production costs comparable to those of conventional antivibration bushes.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and further objects, features and advantages of the present invention will become apparent from the following description of a preferred embodiment with reference to the accompanying drawings, wherein like numerals are used to represent like elements and wherein:

Fig. 1 is a schematic sectional view of a preferred embodiment of the antivibration bush of the present invention, illustrating a state before an outer tubular metal member is pressingly fitted on;

Fig. 2 is a schematic sectional view of the embodiment, illustrating a state after the outer tubular metal member of the antivibration bush has been pressingly fitted on;

Fig. 3 is a schematic plan view of an antivibration bush mold according to the embodiment, illustrating a parting surface of the mold;

Fig. 4 is a schematic sectional view of a modification of the

embodiment of the present invention, illustrating a state before an outer tubular metal member is pressingly fitted on;

Fig. 5 is a schematic sectional view of the modification, illustrating a state after the outer tubular metal member of the antivibration bush has been pressingly fitted on;

Fig. 6 is a schematic sectional view of a conventional antivibration bush, illustrating a state before an outer tubular metal member is pressingly fitted on;

Fig. 7 is a schematic sectional view of the conventional antivibration bush, illustrating a state after the outer tubular metal member has been pressingly fitted on; and

Fig. 8 is a schematic sectional view of another conventional antivibration bush, illustrating a state before an outer tubular metal member is pressingly fitted on.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

A preferred embodiment of the present invention will be described in detail hereinafter with reference to the accompanying drawings.

Figs. 1 and 2 illustrate in section a vehicular antivibration bush according to a preferred embodiment of the present invention before and after an outer tubular metal member is pressingly fitted on. In the antivibration bush, a rubber elastic layer 20 is adhered by vulcanization to an outer peripheral surface of an inner tubular metal member 10. The rubber elastic layer 20 has a tubular elastic main body 21 that extends over an intermediate portion of the inner tubular metal member 10 in the direction of its axis, excluding opposite end-adjacent portions of the inner tubular metal member 10. Opposite end-adjacent portions of the elastic main body 21 are

tap red. The rubber elastic layer 20 also has a pair of ring-like elastic flange portions 22 that are disposed near the opposite ends of the inner tubular metal member 10 and spaced apart from the elastic main body 21 by gaps W. An outer peripheral portion of each elastic flange portion 22 is slightly inclined toward the elastic main body 21.

The elastic main body 21 is formed from a first rubber having a great sliding resistance relative to an outer tubular metal member 40 (described later), more specifically, having a high friction coefficient of about 1.5-2.0. The elastic flange portions 22 are formed from a second rubber that is a self-lubricating rubber containing fatty amide within the range of 2-10 phr. The friction coefficient of the second rubber is within the range of 0.1-0.5.

The rubber elastic layer 20 includes portions formed from two different materials, that is, the elastic main body 21 formed from the first rubber made of an ordinary rubber material and the elastic flange portions 22 formed from the second rubber made of a self-lubricating rubber material. In this embodiment, the antivibration bush moldings of these two different materials are simultaneously molded by performing the molding closing operation once. This molding method will be described below.

A mold 30 for the molding process is formed, as shown in Fig. 3, by combining two mold parts 30a, 30b of generally symmetrical configurations with parting surfaces 30a1 facing each other. Fig. 3 shows an example of the configuration of the mold part 30a. The mold part 30a will be described below.

The mold part 30a has a cavity 31 in a central portion of the parting surface 30a1. The cavity 31 includes a semi-cylindrical

inner tubular metal member placement portion 31a for placing the inner tubular metal member 10, and an intermediate cavity portion 31b expanding in radial directions into a generally half-tubular shape from an axially intermediate portion of the inner tubular metal member placement portion 31a, that is, an intermediate portion in the direction of an axis thereof, and a pair of end cavity portions 31c expanding in radial directions into a generally half-annular shape from opposite end-adjacent portions of the inner tubular metal member placement portion 31a, that is, opposite end-adjacent portions in the direction of its axis. The end cavity portions 31c are apart from the intermediate cavity portion 31b by intervals. An outer peripheral portion of each end cavity portion 31c is slightly inclined toward the intermediate cavity portion 31b.

In the parting surface 30a1, a first injection hole 32a extends from an outer limit portion of the intermediate cavity portion 31b to an end surface of the mold 30, in a rectangularly bent shape. A first injection opening 32b is formed in a funnel-like shape at an end of the first injection hole 32a on the side of the mold end surface. Furthermore, an injection hole extends from an outer limit portion of each end cavity portion 31c, and the two injection holes merge into one hole extending to an end surface of the mold 30, thereby forming a second injection hole 32c. A second injection opening 32d is formed in a funnel-like shape at an end of the second injection hole 32c on the side of the mold end surface.

Molding of the antivibration bush using the above-described mold 30 is performed by first placing the inner tubular metal member 10 in the inner tubular metal member placement portion 31a of the cavity 31 and then closing the mold 30, that is, joining the mold parts

30a and 30b. Then, the ordinary first rubber is injected into the intermediate cavity portion 31b through the first injection opening 32b and the first injection hole 31a, using a first rubber injection device (not shown). The second rubber made of a self-lubricating rubber is injected into the two end cavity portions 31c through the second injection opening 32d and the second injection hole 32c, using a second rubber injection device (not shown). After that, the mold 30 is opened to take out the molding. Rubber portions molded by the first and second injection holes 32a, 32c are removed from the molding, thereby producing an antivibration bush molding.

Since this molding method is able to mold two different kinds of rubber materials by performing the mold closing operation once, the antivibration bush molding process can be simplified to a level comparable to the molding processes for conventional antivibration bushes. The increase in production costs can thereby be minimized or substantially eliminated. The two rubber materials may be injected in a reversed sequence or simultaneously.

The antivibration bush molding with the rubber elastic layer 20 formed as described above is fitted into the outer tubular metal member 40 so that the elastic main body 21 presses an inner peripheral surface of the outer tubular metal member 40 as shown in Fig. 2, thereby producing an antivibration bush. The outer tubular metal member 40 is normally an arm collar of an automobile suspension arm. The outer tubular metal member 40 used is a member formed of a metal and plated with zinc or the like, or a member made of iron and coated with an electrodeposition coating. The inside diameter of the outer tubular metal member 40 is smaller than the outside diameter of the elastic flange portions 22. Therefore, when the antivibration bush

molding is pressingly fitted into the outer tubular metal member 40, the elastic main body 21 is compressed in diameter, and expanded in the direction of its axis to contact an inner side end of each elastic flange portion 22. Opposite end surfaces 40a of the outer tubular metal member 40 contact inner side end surfaces 22a of the elastic flange portions 22. The elastic flange portions 22 therefore prevent the outer tubular metal member 40 from falling apart from the rubber elastic layer 20.

When the inner tubular metal member 10 of the antivibration bush receives abrupt force in a torsional direction, friction occurs between the inner side surfaces 22a of the elastic flange portions 22 and end surfaces 40a of the outer tubular metal member 40. However, since the elastic flange portions 22 are formed from the second rubber made of a self-lubricating rubber material with a low friction coefficient, the friction between the inner side surfaces 22a of the elastic flange portions 22 and the end surfaces 40a of the outer tubular metal member 40 is reduced. Therefore, stick-slip noise caused by friction therebetween is effectively suppressed. The noises that annoy occupants of the vehicle are correspondingly reduced.

While, in the above embodiment, the elastic flange portions 22 are provided on opposite end portions of the inner tubular metal member 10, a modification as shown in Figs. 4 and 5 is also possible wherein only one end portion of the inner tubular metal member 10 is provided with an elastic flange portion 23 formed from the second rubber, that is, a self-lubricating rubber material having a low friction coefficient. In this modification, most of the other portion of the inner tubular metal member 10 is covered with an

elastic main body 24 formed from the first rubber, that is, an ordinary rubber material having a friction coefficient greater than that of the second rubber. An outer tubular metal member 41 is pressingly fitted over the elastic main body 24. This modification also reduces friction between an inner side surface 23a of the elastic flange portion 23 and a corresponding end surface 41a of the outer tubular metal member 41 if such friction occurs, thereby effectively suppressing stick-slip noise by friction therebetween.

The performance of the antivibration bush of the present invention will be described below, in comparison with the performance of conventional antivibration bushes.

A test example of the antivibration bush of the present invention as described above was subjected to noise tests under conditions described below. In the test example, the friction coefficient of the second rubber made of a self-lubricating rubber material was 0.15, and the amount of fatty amide compounded was 8 phr.

Four different types of conventional antivibration bushes were prepared as comparative examples. Conventional bush No. 1 had a construction as illustrated in Fig. 7, and had a relatively high rubber hardness (spring constant perpendicular to the axis $k_R = 22358$ N/mm, and spring constant parallel to the axis $k_S = 1820$ N/mm). Conventional bush No. 2 had the same construction as conventional bush No. 1, but had a reduced rubber hardness ($k_R = 18131$ N/mm, and $k_S = 1476$ N/mm). Conventional bush No. 3 had an increased dimension of the elastic flanges in the direction of its axis, and had protuberances as shown in Fig. 8. Conventional bush No. 4 had protuberances as shown in Fig. 8.

In conventional bush No. 3, the dimension of the elastic

flange in the direction of its axis was increased to reduce the pressure from the outer tubular metal member onto the rubber flange portions so that the stick-slip energy would be reduced and, therefore, noise would be reduced.

(1) Test Conditions

Atmosphere temperature: a normal temperature of 23 °C,
and -15 °C

Torsional angle: $\pm 3^\circ$ to $\pm 15^\circ$

(2) Test Items

Sensory evaluation: Evaluation was made depending on whether abnormal noise was perceived or not, and magnitudes of noise. If abnormal noise was perceived, three evaluation levels were provided: low (perceived with an ear placed close to the bush), intermediate (perceived 2 m apart), and loud (perceived 5 m apart). If relative movements were observed between the elastic flange portion and the outer tubular metal member even though no abnormal noise was perceived, occurrence of relative movements was recorded.

Vibration acceleration: Vibration acceleration was indicated by measurements determined by an acceleration sensor in the unit of g (gravitational acceleration).

Test results are shown in Tables 1 and 2.

Table 1

| | | Test Example | | Convention Bush No. 1 | | Convention Bush No. 2 | |
|---------------------------------|-------------|----------------------|--------------------|-----------------------|----------------|-----------------------|----------------|
| Temper-a-ture | Oscil-ation | Sen-sory evalua-tion | Accel-era-tion | Sen-sory evalua-tion | Accel-era-tion | Sen-sory evalua-tion | Accel-era-tion |
| Nor-mal tem-per-a-ture 23 °C | ± 2 ° | No Ab-normal noise | 0 g | No Ab-normal noise | 0 g | No | 0 g |
| | ± 3 ° | " | " | " | " | " | " |
| | ± 4 ° | " | " | " | " | " | " |
| | ± 5 ° | " | " | " | " | " | " |
| | ± 6 ° | " | " | " | " | " | " |
| | ± 7 ° | " | " | " | " | " | " |
| | ± 8 ° | " | relat-ed move-ment | " | " | relat-ed move-ment | " |
| | ± 15 ° | " | No Ab normal noise | " | " | No Ab normal noise | " |

Table 1 Continued

| | | Test Example | | Convention Bush No. 1 | | Convention Bush No. 2 | |
|---|-----------------|---------------------------------|-----------------------|----------------------------------|-----------------------|--------------------------------|-----------------------|
| Tem- per- a- ture | Oscil- ation | Sen- sory evalu- ation | Accel era- tion | Sen- sory evalu - ation | Accel era- tion | Sen- sory evalu ation | Accel era- tion |
| Nor- mal tem- per- a- ture -15 °C | ± 2 ° | No Ab- normal noise | 0 g | No Ab- normal noise | 0 g | No | 0 g |
| | ± 3 ° | " | " | " | " | " | " |
| | ± 4 ° | " | " | " | " | " | " |
| | ± 5 ° | " | " | " | " | " | " |
| | ± 6 ° | " | " | " | " | " | " |
| | ± 7 ° | " | " | " | 0.28g | " | 0.25g |
| | ± 8 ° | " | " | Low | 0.40g | " | 0.40g |
| | ± 9 ° | " | " | inter- mediate | 0.55g | " | 0.70g |
| | ± 10 ° | " | " | Loud | 0.82g | inter medi- ate | 1.32g |
| | ± 11 ° | " | " | - | - | Loud | 2.70g |
| | ± 12 ° | " | " | - | - | - | - |

Table 2

| | | Convention Bush No. 3 | | Convention Bush No. 4 | |
|--|-----------------|---------------------------------|------------------------|---------------------------------|------------------------|
| Tem- per- a- ture | Oscil- ation | Sen- sory evalu- ation | Accel- era- tion | Sen- sory evalu- ation | Accel- era- tion |
| Nor- mal tem- per- a- ture 23 °C | ± 2 ° | No Ab- normal noise | 0 g | No Ab- normal noise | 0 g |
| | ± 3 ° | Related move- ment | " | " | " |
| | ± 4 ° | No Ab- normal noise | " | " | " |
| | ± 5 ° | " | " | " | " |
| | ± 6 ° | " | " | " | " |
| | ± 7 ° | " | " | " | " |
| | ± 8 ° | " | " | Related move- ment | " |
| | ± 15 ° | " | " | No Ab- normal noise | " |

Table 2 Continued

| | | Convention Bush No. 3 | | Convention Bush No. 4 | |
|---|-----------------|---------------------------------|------------------------|---------------------------------|------------------------|
| Tem- per- a- ture | Oscil- ation | Sen- sory evalu- ation | Accel- era- tion | Sen- sory evalu- ation | Accel- era- tion |
| Nor- mal tem- per- a- ture -15 °C | ± 2 ° | No Ab- normal noise | 0 g | No Ab- normal noise | 0 g |
| | ± 3 ° | " | " | " | " |
| | ± 4 ° | Low | 0.40g | " | " |
| | ± 5 ° | Low | 0.40g | " | " |
| | ± 6 ° | inter- mediate | 0.45g | " | " |
| | ± 7 ° | inter- mediate | 0.60g | " | 0.35g |
| | ± 8 ° | inter- mediate | 0.55g | Low | 0.94g |
| | ± 9 ° | inter- mediate | 0.60g | inter- mediate | 1.15g |
| | ± 10 ° | inter- mediate | 0.78g | Loud | 1.30g |
| | ± 11 ° | inter- mediate | 1.05g | - | - |
| | ± 12 ° | inter- mediate | 0.70g | - | - |

As shown in Tables 1 and 2, the test example of the invention did not produce any perceivable abnormal noise at either the normal temperature or -15°C. On the other hand, the conventional antivibration bushes produced perceivable abnormal noise, particularly, at -15°C. The results clearly show the effectiveness of the present invention in suppressing stick-slip noise.

While the present invention has been described with reference to what is presently considered to be a preferred embodiment thereof, it is to be understood that the invention is not limited to the disclosed embodiment or constructions. To the contrary, the invention is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

WHAT IS CLAIMED IS:

1. An antivibration bush comprising:
a cylindrical inner tubular metal member;
an elastic flange portion formed in an annular shape from a second rubber with a low friction coefficient on an outer peripheral surface of the inner tubular metal member at least on an end side thereof;
an elastic main body formed in a tubular shape from a first rubber whose friction coefficient is greater than that of the second rubber, on an outer peripheral surface of the inner tubular metal member with a gap formed between the elastic main body and the elastic flange portion;
and an outer tubular metal member pressingly fitted over an outer peripheral surface of the elastic main body, the outer tubular metal member having an end portion that contacts an end surface of the elastic flange portion, the end surface being relatively near to the elastic main body.
2. An anti-vibration bush according to claim 1, wherein the friction coefficient of the second rubber is within a range of 0.1-0.5.
3. An anti-vibration bush according to claim 1, wherein the friction coefficient of the first rubber is within a range of 1.5-2.0.
4. An anti-vibration bush according to claim 1, wherein the second rubber contains fatty amide.
5. An anti-vibration bush according to claim 4, wherein the amount of the fatty amide contained is 2-10 phr.
6. A method for producing an antivibration bush,

comprising the steps of:

disposing a cylindrical inner tubular metal member in an inner tubular metal member placement cavity portion formed in a mold separable into two mold parts, the mold having, in addition to the inner tubular metal member placement cavity portion, at least one end cavity portion expanding in radial directions into a generally annular shape from an end portion of the inner tubular metal member placement cavity portion in the direction of an axis thereof, a second injection hole extending from an end surface of the mold to the end cavity portion, an intermediate cavity portion expanding in radial directions into a generally tubular shape from the inner tubular metal member placement cavity portion, the intermediate cavity portion being apart from the end cavity portion by an interval, and a first injection hole extending from an end surface of the mold to the intermediate cavity portion, the aforementioned cavities being distributed to the two mold parts substantially symmetrically about parting surfaces of the mold parts;

closing the mold;

injecting a second rubber having a low friction coefficient through the second injection hole into the end cavity portion; and

injecting a first rubber having a friction coefficient that is greater than the friction coefficient of the second rubber, through the first injection hole into the intermediate cavity portion.

7. An antivibration bush substantially as hereinbefore described with reference to Figs. 1 to 3 or Figs. 4 and 5 of the accompanying drawings.

8. A method for producing an antivibration bush, substantially as hereinbefore described with reference to Figs. 1 to 5 of the accompanying drawings.



Application No: GB 9719716.4
Claims searched: 1, 6

Examiner: Howard Reeve
Date of search: 28 October 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): F2S (SCF)

Int Cl (Ed.6): F16F 1/38

Other:

Documents considered to be relevant:

| Category | Identity of document and relevant passage | Relevant to claims |
|----------|---|--------------------|
| X | GB 0780233 (HOWARD CLAYTON-WRIGHT LIMITED), see especially rings 13 | 1 |
| X | GB 0527780 (SILENTBLOC LIMITED), see bushes F | 1 |
| X | US 5439203 (KATSUYA HADANO), see rubber members 18A, B in figs 2, 4 | 1 |

| | |
|---|--|
| X Document indicating lack of novelty or inventive step | A Document indicating technological background and/or state of the art. |
| Y Document indicating lack of inventive step if combined with one or more other documents of same category. | P Document published on or after the declared priority date but before the filing date of this invention. |
| & Member of the same patent family | E Patent document published on or after, but with priority date earlier than, the filing date of this application. |